LESSON 10.7

Using Simultaneous Equations

WRITING EQUATIONS

Some problems can be solved by solving systems of equations.

Example: The members of the advanced music class of Alaberg High School gave a spring concert. Afterwards they wanted to know how many adults had attended the concert. They knew they had sold 351 tickets, and receipts totaled $1078.50. If adult tickets were $4.00 and student tickets were $2.50, how many of each kind had they sold?

Identify the variables:

Let x = the number of adult tickets.

Let y = the number of student tickets.

Write the equations:

$x + y = 351$

$4.00x + 2.50y = 1078.50$

1. Interpret the two equations in terms of this problem.
2. Solve the system. Interpret your answer.
3. The following year 536 tickets were sold, with total receipts of $1656.50. If the ticket prices were the same, how many of each type were sold? Write and solve a system of equations.
4. Compare the system you wrote in problem 3 with the one in the example. What is the same, and what is different? Explain.

Writing and solving a system of equations is an efficient way to solve the problems in this lesson. However, there are other ways to solve them, such as using tables, graphs, or by trial and error. Regardless of what method you use, show your work clearly and express your solutions in terms of the original problem.

GADGETS AND WIDGETS

5. Ken walked into Kate's Store. "How much for five of those gidgets and eight of those gadgets?" he asked. "That would be $11.27 without tax," Kate replied. "Oops," said Ken. "I really need eight of the gidgets and five of the gadgets." The total was $11.87 before tax. What was the cost of a gidget? What was the cost of a gadget?
6. It takes 2.5 kg of copper and 4 kg of nickel to manufacture a widget. A smidget requires 7 kg of copper and 3 kg of nickel. How many widgets and how many smidgets could you manufacture if you had
   a. 74 kg of copper and 61 kg of nickel?
   b. 80 kg of copper and 43 kg of nickel?

MOZART

7. Liza planned to tape a 12-hour Mozart Marathon. She wanted to use a combination of 90-minute and 60-minute tapes and to fill each one completely.
   a. What possible combinations of tapes could she use?
   b. If she used a total of ten tapes, and filled all of them completely, how many of each did she use?
8. Shelly earned some money assisting with preparations for Mozart's 200th birthday party. She made $6 per hour for addressing invitations and $8 per hour for helping to set up the stage and auditorium for the concert. She received a total of $352. How many hours did she work at each job?

COLLEGE APPLICATIONS

9. Garabel College newspaper reported that 1089 students had applied to the college in the two-year period 1992-1994. There were 20% more applicants in the 93-94 school year than in the 92-93 school year. How many students applied to Garabel in each of the two years?

10. The number of students applying to Garabel in 92-93 was a 12% increase over the number in 91-92. How many students applied in 91-92?

11. Ms. Pavlov, the Director of Admissions, congratulated the admissions staff. "We had 32% more applicants in 93-94 than in 91-92." What is wrong with her statement?

12. The admissions department is expanding. Their budget has been increased by $1800 per week to hire new staff. They will hire some part-time student interviewers and tour guides at $5.25 per hour and student secretaries at $6.50 per hour. Interviewers and tour guides work approximately 10 hours per week, and secretaries work 15 hours per week. If they need one secretary for every five interviewers and tour guides, how many of each should they hire?

MEXICAN FOOD

At La Brea's Mexican Restaurant, you can buy a Family Feast of eight enchiladas and twelve tamales for $19.60. The Couple's Combo has four tamales and four enchiladas, and sells for $8.00.

13. Based on these prices, what price would you recommend for the Single's Special, which has two tamales and one enchilada?

14. Mr. G. La Brea wants to add a new item to the restaurant's menu. How should he price the Double Dozen, which has a dozen enchiladas and a dozen tamales?

CHEMISTRY

15. One solution is 80% acid. Another is 20% acid. Rosemary wants 500 liters of a solution that is 70% acid. How much of each solution should she use?

GEOMETRY

16. A 30-cm string loop goes around two thumbtacks that are ten cm apart. A third thumbtack is added, so that the loop makes a right triangle. How far is the new tack from the old ones?

17. A rectangle has perimeter 30. If you add 3 to the width, and subtract 4 from the length, the area does not change. What are the length and width of the original rectangle?

PROBLEMATIC PROBLEMS

Systems of simultaneous linear equations are an important and widely-used application of mathematics. Usually they involve many variables and are solved with the help of more advanced math, plus computers or programmable calculators. The lessons in this chapter were intended to give you an introduction to this sort of mathematics. However, some of the problems in this lesson are not very realistic.

18. Report Discuss:

- How could some of the problems be solved (or avoided) without using algebra?
- Which problems are backwards? (You are given information that could have been figured out only by someone who already knew the answer to the problem.)
- Which problems seem to start from unrealistic numbers?
- Which problems could arise in the real world?
- Which problems are really puzzles created to help you learn algebra?